ISSN: 0975 - 4539
IJBSAT (2019), 10(2):6-12

DOI: http://doi.org/10.5281/zenodo.3384587

# Health of seedlings and saplings of popular timber species in Guyana

Shuba Soamandaugh, Ria Bisnauth, Varsha Gopaul, Ryan Dey
Forest Resources Management Division, Guyana Forestry Commission, 1 Water Street, Kingston, Georgetown.
sntsoamandaugh@gmail.com riaokbisnauth@gmail.com varshakgopaul@gmail.com ryandey2002@gmail.com

ABSTRACT:
An assessment of the density of seeds, seedlings and saplings was done for three (3) popular timber species *Chlorocardium rodiei* (Greenheart), *Peltogyne venosa* (Purpleheart) and *Swartzia leiocalycina* (Wamara). Trees that met the Sustainable Forest Management (SFM) criteria for harvesting were selected as sample individuals. The health and condition of the individuals at these stages were recorded. This filled a noticeable gap in information on tree population and the impacts of harvesting on seedlings and saplings in tropical forests that recuperate by natural regeneration. It was noted that fungi, other diseases and herbivory were minimal in all species; with C. rodiei producing the largest seeds, seedlings and saplings.
For all species, the majority of seedlings and saplings were assessed as healthy and viable replacements for their parent tree in case of harvesting. There is need for species-specific guidelines to ensure sustained utilization without causing detriment to the population.

## INTRODUCTION

Guyana's forest has a wide variety of tree species with only a small percentage fully utilized for timber production. For this reason the over-reliance of the sector on a few species has been cited as an area for further studies. The SFM Guidelines in Guyana are based on a system of selective logging with natural regeneration on a cutting cycle of 60 years at a maximum harvesting intensity of 20m$^3$/ha [1]. Reduced impact logging (RIL) is practiced by all logging concession holders along with a suite of guidelines aimed at reducing the degradation of soil, water, air and biological diversity.

In 2015, the United Kingdom Environmental Agency (UKEA) released a briefing note on tropical woods. [2] Stated that "it does not have sufficient evidence that forests of origin are sustainably managed" for Greenheart, despite adequate evidence of legality. In light of these concerns, an analysis of the lifecycle of popular timber species was needed. While forest inventory in Guyana captured the population of trees 10 cm dbh and above for purposes of recruitment monitoring, there is limited information on seeds, seedlings and saplings.

For Guyana's forests, average canopy height is approximately 35 m and emergent species like *P. venosa* around 50 m; stem density is around 180 stems/ha for trees 20 cm dbh and above. The three (3) selected species have been mainstays for harvesting and export for the past decade. *For P. venosa* an average of 327,986 m$^3$/year, *C. rodiei* 68,876 m$^3$/year and *S. leiocalycino* 39,370 m$^3$/year were harvested during the period 2010-2014 [3].

Based on literature, all three species are locally frequent or dominant in prevalent forests types in Guyana [4]. *C. rodiei* is known for occurring in reefs, with flowering during March to June and fruiting from March to May. These seeds rarely disperse far from the parent trees and germinate in approximately 4-6 months [4].

For *P. venosa* and *S. leiocalycina,* there is limited information available on seeding to sapling stages. *S. leiocalycina* flowers during periods December to February and June to July; and fruits during periods March thru May and September and October [4]. Seeds are thought to be dispersed by monkeys and birds and germinate within a month. Similarly, for *P. venosa* seeds are thought to be dispersed by spider monkeys; however based on the emergent nature of this species, it is also likely dispersed by wind [4, 5]. Assessment of the

ISSN: 0975 - 4539
IJBSAT (2019), 10(2):6-12

DOI: http://doi.org/10.5281/zenodo.3384587

flowering to sapling stages for these two species is hindered by their seed dispersal methods and the height.

## STUDY SITE AND METHOD

Study was done in two locations in Central Guyana in mixed forest type (see map 1). Both areas have experienced moderate human disturbance in the form of infrastructure development or logging in the past 10 years.

A sample frame of all harvestable trees (i.e. trees of good stem quality that are not located close to water ways or on steep landforms and that are 35 cm dbh or greater) for each species was prepared for blocks of 100 ha. Ten (10) trees for each species were randomly selected and a sample plot established.

Data was collected in two sites in Central Guyana: Moraballi Forest Reserve (top) and a forest concession (bottom),

Circular plots were established using the circumference of the tree canopy. For *C. rodiei* plots, the circular plots were extended beyond the canopy coverage where slopes exist and seeds could roll further. Seeds within each circular plot were recorded based on the following classification: fresh – recently fell (F), germinating/germinated (G), eaten (E), affected by fungus (AF), germinated but died (GD), rotten (R). While seedling and sapling were recorded using the following health codes: diseased (D), attacked by animal (AA), died (DD), other damage (O). Seedlings were classified as bodies with at least one leaf up to 3cm dbh and saplings 4-9cm dbh.

## RESULTS AND DISCUSSION

The average number of seeds per harvestable *C. rodiei* tree was calculated as 53 with 48 estimated as viable for germination. Based on the results, *C. rodiei* seeds are least affected by fungus and predation. On average, 53 seedlings were established per parent tree. It was observed that 49% of the established seedlings were healthy and free of defects, while 23% appeared diseased. A large percent of seeds germinate and enter the seedling and sapling phase and little less than half of the seedlings are alive and unaffected by disease and pests.

Seedling and sapling dispersal diameter of 8-19 m was noted for *C. rodiei.* This is likely influenced by the size, weight and dispersal methods of this species.


Figure 1: Health of seeds for *C. rodiei*

ISSN: 0975 - 4539
IJBSAT (2019), 10(2):6-12

DOI: http://doi.org/10.5281/zenodo.3384587

Map 1: Location of sample sites for data collect.

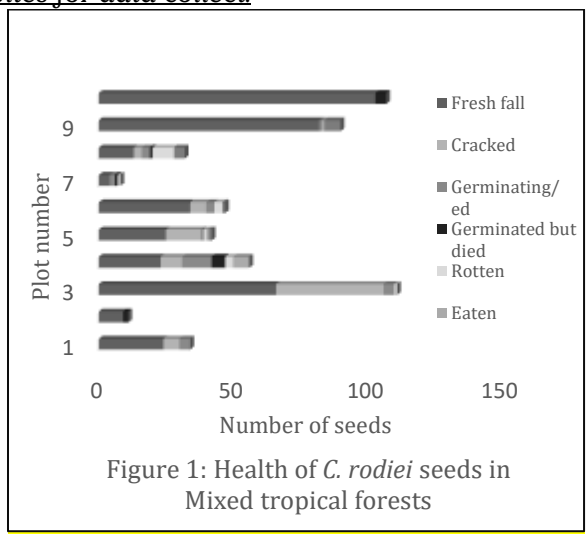


Figure 1: Health of *C. rodiei* seeds in Mixed tropical forests

Figure 1: Number of seeds recorded and health conditions for each *C. rodiei* plot measured in the Moraballi Forest Reserve.

Based on pre-harvest inventory from logging companies in mixed forest types, an average of 513 harvestable *C. rodiei* trees can be found in a 100 ha block. If 75% of those trees (384 trees) were harvested, approximately 9,984 healthy seedling and saplings would potentially be available for regeneration in the gaps. [6] Noted the majority of collateral damage during harvested affected trees with smaller dbh. Nevertheless, with the implementation of RIL and the resilience of trees at the seedling and sapling phase, this number is not likely to be greatly influenced.

Table 1: the summary of seeds, seedling and sapling data collected for *C. rodiei*

| **SEED HEALTH** | **Total (plots 1-10)** | **%** |
|---|---|---|
| Fresh fall | 383 | 71 |
| Cracked | 76 | 14 |
| Germinating/ed | 29 | 5 |
| Germinated but died | 13 | 2 |
| Rotten | 17 | 3 |
| Eaten | 8 | 1 |
| Attacked by Fungus | 12 | 2 |
| **Total** | **538** | **100** |
| **SEEDLING/SAPLING HEALTH** | **Total (plots 1-10)** | **%** |
| Healthy | 263 | 49 |
| Herbivory | 43 | 8 |
| Dead | 110 | 20 |
| Diseased | 121 | 23 |
| **Total** | **537** | **100** |

Table 1. Percentage of seedlings and saplings in each health category for all individuals measured for *C. rodiei*.

ISSN: 0975 - 4539
IJBSAT (2019), 10(2):6-12

DOI: http://doi.org/10.5281/zenodo.3384587

For *P. venosa*, dead nor diseased seedlings and saplings were not observed for this species. On average, 6 seedlings/saplings were established per harvestable tree with the majority being healthy. It was not uncommon for harvestable trees to have no seedlings or saplings within an 8m radius of the tree.

Of course seeds could not be assessed because of the emergent nature of this species. Further, a dispersal diameter of 10m from the parent tree was noted for seedlings and saplings. This is likely to be a localized dispersal radii, since seeds and fruits (a leathery pod) are dispersed by spider monkeys (*Ateles*) that are known to have a home range of around 220-255 ha, and are known for swallowing seeds whole and disperse around 132 known species of tree and lianas [5, 7]. During data collection, a radius of 8 m was searched for the presence of seedling and saplings but none were found beyond 5 m.

Based on pre-harvest information approximately 18 harvestable *P. venosa* trees can be found in a 100 ha block, if 80% (14 trees) were harvested then approximately 84 healthy seedling and saplings would be available for regeneration in the canopy gap created.

Table 2: seedlings and saplings recorded for harvestable *P. venosa* tree

| ***P. venosa* (Plots 1-10) Forest Concession** | | |
|---|---|---|
| **Seedling/sapling health** | Total | % |
| **Healthy** | 62 | 91 |
| **Herbivory** | 6 | 9 |
| **Total** | **68** | **100** |

Table 2. Percentage of seedlings and saplings in each health category for all individuals measured for *P. venosa* in a forest concession. Only two conditions were noted for this species.

*S. leiocalycina* on average had 9 seedlings and saplings established per tree, 30% of the sampled trees did not have seedlings or saplings. Herbivory affected 10% of seedlings/saplings however, the vast majority were healthy. This species had a dispersal diameter of 4.6 to 10.4 m and similarly to *P. venosa*, seed information was not available.

On average 75 harvestable *S. leiocalycina* trees were recorded per 100 ha block in mixed forests. If 80% (60) trees were harvested at a given time, then approximately 480 healthy seedlings and saplings would be available for regeneration in that 100 ha.

ISSN: 0975 - 4539
IJBSAT (2019), 10(2):6-12

DOI: http://doi.org/10.5281/zenodo.3384587

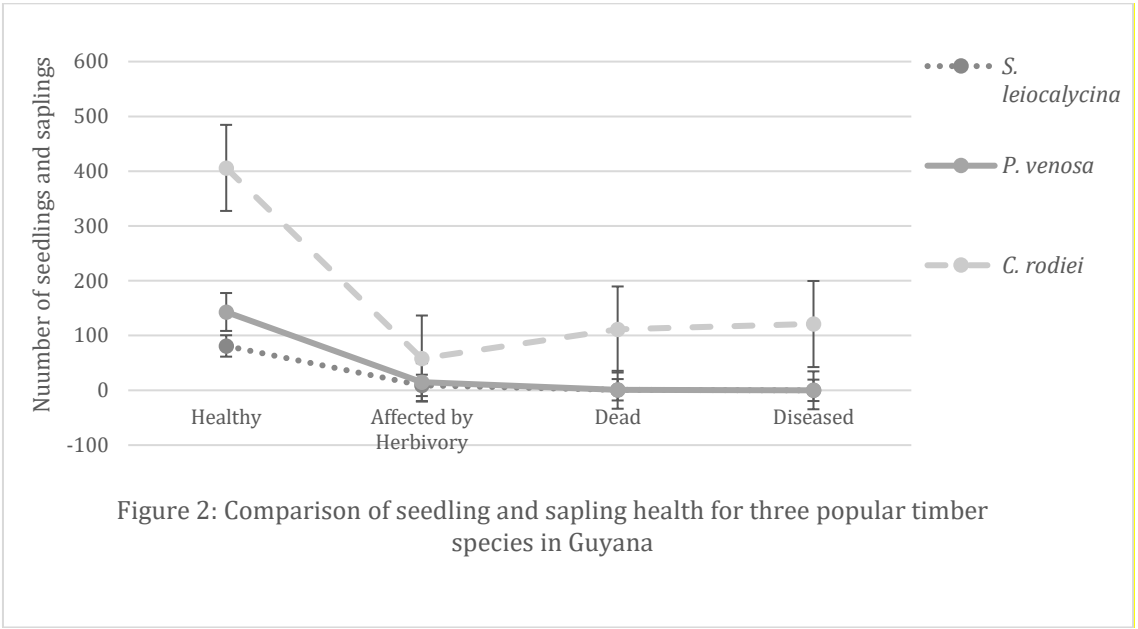


Figure 2: Comparison of seedling and sapling health for three popular timber species in Guyana

Figure 2. All species had high numbers of healthy individuals and low occurrences of herbivory and disease.

Table 3: seedlings and saplings recorded for harvestable *S. leiocalycina* trees

| ***S. leiocalycina* (Plots 1-10) Forest Concession** | | |
|---|---|---|
| **Seedling/sapling health** | **Total** | **%** |
| Healthy | 81 | 89 |
| Herbivory | 9 | 10 |
| Dead | 1 | 1 |
| **Total** | **91** | **100** |

Table 3. Percentage of seedlings and saplings in each health category for all individuals measured for *S. leiocalycina* in a forest concession.

*C. rodiei* produced the largest number of seedling and sapling per tree with the highest number of unhealthy individuals. *S. leiocalycina* and *P. venosa* produced fewer seedlings and saplings of lower heights and dbh. For all species, the majority of seedlings and saplings recorded were healthy and viable and located within a radius of 10 m from the parent trees.

There was no significant difference in health condition of seedlings and sapling within species (p-0.28 at a 0.05 significance level). However, there was a significant difference in health condition of seedlings and saplings among the three different species (p- 0.03) using one way ANOVA.

## CONCLUSION AND RECOMMENDATIONS

These three popular timber species do produce viable, healthy seedlings and saplings populations for natural regeneration. With effective enforcement of RIL and SFM guidelines timber harvesting of these species can be sustained. Incorporation of new guidelines based on species specific

ISSN: 0975 - 4539
IJBSAT (2019), 10(2):6-12

DOI: http://doi.org/10.5281/zenodo.3384587

information on flowering, seed dispersal seedlings and saplings stages can further improve management of popular timber species in Guyana. It will improve confidence that Guyana's timber species are managed sustainably and that there is no threat to current populations from logging. More species specific information needs to be collected on commonly harvested timber species and other non-timber forest products to further contribute to improving SFM guidelines.

## REFERENCES

[1] Guyana Forestry Commission. Code of Practice (2018). 45 pages. https://www.forestry.gov.gy/wp-content/uploads/2018/07/CoP-for-Forest-Operations-2018.pdf (last accessed May 13, 2019).

[2] United Kingdom Environment Agency (2015) Briefing Note on use of Tropical Hardwoods, page 2.

[3] Guyana Forestry Commission (2016). Forest Sector Information Report 2016. 1-58.

[4] Polak, A.M. (1992) Major Timber Trees of Guyana. The Tropenbos Foundation, ISBN 90-5113-013-9, 70-240.

[5] Van Roosmalen, M. G. M. (1985). Habitat preferences, diet, feeding strategy and social organization of the black spider monkey (Ateles paniscus paniscus Linnaeus 1758) in Surinam. Acta Amazonica 15(3-4): 1—238

[6] Soamandaugh, S. (2017). An analysis of Collateral Damage Resulting from Selective Logging in a Large Forest Concession in Guyana, Imperial Journal of Interdisciplinary Research (IJIR) Vol-3, Issue-6, 2017 ISSN: 2454-1362. 906.

[7] Van Roosmalen, M. G. M. (1980). Habitat preferences, diet, feeding strategy and social organisation of the black spider monkey (*Ateles paniscus paniscus* Linnaeus 1758) in Surinam. Doctoral Thesis, Agricultural University of Wageningen,

IJBSAT

ISSN: 0975 - 4539
IJBSAT (2019), 10(2):6-12

DOI: http://doi.org/10.5281/zenodo.3384587

GUYANA FORESTRY COMMISSION
1 Water Street, Kingston, P.O. Box 1017, Georgetown, Guyana.
Tel Nos. 592-226-7271-4, 592-226-6407 Fax: 592-226-8956
Website: www.forestry.gov.gy

July 16, 2019

Editor

IJBST and its Associate Journals

Dear Sir/madam,

**RE: Manuscript submit ted**

Data collection and analysis was done by the team (S. Soamandaugh, R. Bisnauth, V. Gopaul and R. Dey), who are employed in the Forest Resources Management Division (FRMD). There are no foreseeable conflicts and thus acceptable.

For further clarification, feel free to make contact.

Best regards,

GUYANA FORESTRY COMMISSION
DEPUTY COMMISSIONER OF FORESTS
FOREST RESOURCES MANAGEMENT DIVISION
Signature:
Date:

R. Lewis

Deputy Commissioner of Forests

FRMD